SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2004

Return to Aquatic Invasive Species

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INTRODUCTION

The ruffe (*Gymnocephalus cernuus*), an Eurasian percid, was likely introduced to the St. Louis River Estuary (SLRE), MN/WI, during the mid 1980s in the ballast water of an ocean-going ship (Pratt et al. 1992). “L.M. Evrard (U.S. Geological Survey (USGS), Lake Superior Biological Station, Ashland, WI; unpubl. MS.) found that ruffe increased rapidly in abundance and became a dominant member of the fish community by 1991, a status which has persisted”. Ruffe were also discovered in Thunder Bay Harbour, Ontario, in 1991 (Busiahn 1997). Due to potential competition for food and space, ruffe pose a threat to native fish populations (Ruffe Task Force 1992).

Experimental research conducted by the University of Minnesota-Duluth revealed that ruffe consume a significant amount of benthic macroinvertebrate energy (Schuldt et al. 1999). In a presentation of this experiment, co-author Carl Richards, University of Minnesota Natural Resources Research Institute, stated in conclusion: "With the significant amount of benthic macroinvertebrate energy that ruffe are consuming in the St. Louis River Estuary, something has got to be happening in that ecosystem. We are just not seeing it yet." In the same experiment, research also demonstrated significant declines in the growth of yellow perch (*Perca flavescens*), while in the presence of lesser densities of ruffe as well as in the presence of equal or greater densities of ruffe (Henson 1999). However, a statistical analysis conducted by USGS showed no significant relationship between an increasing ruffe population and declining native fish populations in the St. Louis River, MN/WI (Bronte et al. 1998).

In three Wisconsin tributaries just east of the St. Louis River, 1995-2002 trawl data suggests that yellow perch abundance declines in years that ruffe abundance increases (Evrard et al. 1998), (Czypinski et al. 2002). This trend was statistically analyzed and found to be weakly significant for all three tributaries combined (unpublished data, D. H. Ogle, Department of Mathematics, Northland College, Ashland, WI).

As a result of increasing abundance and expansion outside the SLRE (Pratt et al. 1992) and reports of potential impacts on native fish populations, the Aquatic Nuisance Species Task Force declared the ruffe to be a "nuisance species" in the spring of 1992. By authority of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, this designation authorized the formation of a control committee charged with the responsibility of designing and implementing a control plan. The Ruffe Control Program was drafted in 1995 with a revision in 1996 after ruffe were discovered in Lake Huron in 1995 (Kindt et al. 1996). The goal of the Ruffe Control Program is Ato prevent or delay the spread of ruffe in the Great Lakes and inland waters" (Ruffe Control Committee 1996). Surveillance was one of eight objectives designed into the program to achieve this goal.

Formal surveillance efforts began in 1992 to detect pioneering populations of ruffe in the Great Lakes (Slade and Kindt 1992). These efforts were initiated by the U.S. Fish and Wildlife Service (USFWS) - Ashland Fishery Resources Office (Ashland FRO) and the Lake Superior Management Unit (LSMU) of the Ontario Ministry of Natural Resources (OMNR).

The term dedicated surveillance as used herein is defined as surveillance efforts designed and implemented specifically to find and collect ruffe.

The term incidental surveillance as used herein is defined as efforts designed and implemented to collect fish species other than ruffe, but the gear used is also capable of capturing and holding adult and/or juvenile ruffe.

Following is a chronology of ruffe surveillance highlights in the Great Lakes Basin:

1986; Ruffe were discovered in the SLRE (Duluth-Superior Harbor), MN/WI, by the Wisconsin Department of Natural Resources (WDNR). This was the initial sighting of ruffe in North America.

1991; Major ruffe range expansion was detected. A crew from Ashland FRO discovered ruffe in Thunder Bay Harbour, ON, 293 km northeast of the SLRE along the north shore of Lake Superior. This introduction was likely a ballast water transfer from shipping operating between the Duluth/Superior Harbor, MN/WI and Thunder Bay Harbour.

1992; Major ruffe range expansion was detected. Ashland FRO initiated formal surveillance, and located several new populations along the south shore of Lake Superior, thus extending the known range of ruffe to the Sand River, WI, 60 km east of the SLRE.

1993; Major ruffe range expansion was detected. Ashland FRO discovered eight new locations colonized by ruffe in Lake Superior. Ruffe unexpectedly passed by Chequamegon Bay, WI to the Bad River, WI ,156 km east of the SLRE (Busiahn 1997). At the Bad River, ruffe were poised to enter Michigan waters of Lake Superior. USFWS - Lower Great Lakes Fishery Resources Office (LGLFRO) initiated surveillance for ruffe in U.S. waters of Lakes Erie and Ontario (Slade et al. 1994). No ruffe were detected in the Lower Great Lakes.

1994; Major ruffe range expansion was detected. Ashland FRO discovered ruffe at five new locations in Lake Superior, the farthest of which was the Ontonagon River, MI, 276 km east of the SLRE. OMNR-LSMU also captured ruffe in Thunder Bay Harbour, ON, Lake Superior, where they had not been caught since 1991 (Slade et al. 1994). No ruffe were detected in the Lower Great Lakes.

1995; Major ruffe range expansion was detected. Ashland FRO discovered ruffe in Lake Huron near the mouth of the Thunder Bay River, Alpena, MI; this discovery was 480 km east of the Ontonagon River, MI (Busiahn 1997). The Thunder Bay River, MI, was the only confirmed location where ruffe have been captured outside of Lake Superior, and it became the periphery of the ruffe range in the Great Lakes. This introduction into Lake Huron was likely an assisted range expansion from ballast water release. No ruffe were detected in the Lower Great Lakes.

1996; No ruffe range expansion was detected. USFWS - Alpena Fishery Resources Office (Alpena FRO) assumed ruffe surveillance for U.S. waters of Lake Huron and one site in northern Lake Michigan. OMNR-LSMU captured eight ruffe, the largest single-year catch since trawling began in Thunder Bay Harbour, Ontario in 1991 (Czypinski et al. 1997). Five of these specimens were young-of-the-year (YOY) indicating that successful reproduction was occurring in tributaries flowing into Thunder Bay. No ruffe were detected in the Lower Great Lakes.

1997; Some interior ruffe range expansion was detected. Ruffe were discovered in three new locations within their known range in Lake Superior. OMNR conducted dedicated surveillance in Canadian waters of Lake Huron. Ruffe catch rates at peripheral locations were approximately less than or equal to previous years. No ruffe were detected in the Lower Great Lakes. Many agencies, as well as the public, contributed to the surveillance effort by providing voluntary incidental reports.

1998; No ruffe range expansion was detected, but ruffe became the most abundant species captured during fall bottom trawling surveys in the Thunder Bay River, MI, a peripheral range location. OMNR expanded dedicated surveillance into Canadian waters of Lake Erie, and LGLFRO added fall surveys to their dedicated surveillance locations. However, no ruffe were detected in the Lower Great Lakes.

1999; Only minor ruffe range expansion was detected. Ashland FRO detected ruffe in one new location in Lake Superior, the Firesteel River, MI, representing a range expansion of 12 km eastward along the south shore of Lake Superior. The catch per unit effort (CPE) of ruffe in the Thunder Bay River Estuary, Lake Huron increased significantly from one per minute bottom trawling in 1998 to eleven per minute bottom trawling. The majority of the Thunder Bay River ruffe catch were YOY, and ruffe remained the most abundant species captured in trawls from this location. Round goby were first captured from the Thunder Bay River, Lake Huron. No ruffe were detected in the Lower Great Lakes.

2000; No ruffe range expansion was detected. Ruffe catch rates at peripheral locations (Thunder Bay, Harbour, ON, Lake Superior and Thunder Bay River, MI, Lake Huron) were less than or equal to previous years. The exception was the Ontonagon River, MI, Lake Superior where the mean ruffe CPE (No./Hr. bottom trawling) more than doubled from five in 1999 to eleven. The CPE of ruffe in the Thunder Bay River Estuary, Lake Huron declined significantly to 0.3 per minute bottom trawling. Round goby were the most abundant species captured from the Thunder Bay River during surveys. No ruffe were detected in the Lower Great Lakes.

2001; Only minor ruffe range expansion was detected. OMNR detected ruffe near the mouth of the Current River, Lake Superior, which is located within Thunder Bay Harbour, ON. This discovery represents a range expansion of 8 km eastward along the north shore of Lake Superior. A large catch of YOY ruffe from one bottom trawl tow in the Ontonagon River, MI, increased the mean CPE (No./Hr. bottom trawling) of that colony more than 7 fold to 78. However, no ruffe were captured east of the Ontonagon River along the south shore of Lake Superior. Using a 38 mm stretch mesh gillnet (15 m panel), the Red Cliff Tribal Fisheries Dept. in cooperation with Ashland FRO attempted to capture ruffe during a lake whitefish spawning assessment near the Apostle Islands, Lake Superior. The objective of this effort was to assess the level of ruffe predation on lake whitefish eggs; no ruffe were captured in this one-night effort. No ruffe were captured from the Thunder Bay River colony or any other surveyed location in Lake Huron. No ruffe were detected in the Lower Great Lakes.

2002; Major ruffe range expansion was detected. Ashland FRO discovered ruffe in Lake Michigan near Escanaba, MI, and in the Keweenaw Waterway, Lake Superior, 101 km east of the Ontonagon, River, MI, the previous eastern boundary of the ruffe range along the south shore of Lake Superior. In the Ontonagon River, although trawling indicated a decline in ruffe abundance from 2001, the overall trend in ruffe abundance continues to increase. No ruffe expansion was detected in Lake Huron, and no ruffe were captured in trawls within the ruffe range in Lake Huron. Alpena FRO initiated reduction of the spawning ruffe population in the Thunder Bay River, Lake Huron with a 38 mm stretch mesh gillnet (30.5 m panel); a total of 96 ruffe were captured in 52 nights effort. The Red Cliff Tribal Fisheries Dept. in cooperation with Ashland FRO continued a ruffe capture effort during lake whitefish spawning near the Apostle Islands, Lake Superior; no ruffe were captured in this one-night gillnet effort. Due to unseasonably cold weather, no ruffe surveillance was conducted in Thunder Bay Harbour, ON, the eastern boundary of the ruffe range along the north shore of Lake Superior. No ruffe were detected in the Lower Great Lakes.

2003; Only minor ruffe range expansion was detected in Thunder Bay Harbour, ON, Lake Superior, and in Little Bay de Noc, Lake Michigan. However, ruffe CPE in trawls increased significantly in Thunder Bay Harbour from 78/hr. in 2000 to 569/hr. in 2003. In addition, round goby (*Neogobius melanostomus*) and white perch (*Morone americana*) were discovered in Thunder Bay Harbour, the second confirmed location for round goby in Lake Superior. Surveillance was expanded in Lake Michigan by Ashland and Green Bay FRO's to include a total of nine major ports, but no ruffe were captured outside of Little Bay de Noc. Ruffe were not captured from new locations in Lake Huron; however they continue to persist in the Thunder Bay River, MI.

The Red Cliff Tribal Fisheries Dept. in cooperation with Ashland FRO continued a ruffe capture effort during lake trout and lake whitefish spawning near the Apostle Islands, Lake Superior. A total of nine adult ruffe were captured in 19 net-nights; no eggs of any species were found in the ruffe diet analysis. In Lake Huron, Alpena FRO continued reduction of spawning ruffe in the Thunder Bay River, removing a total of 10 ruffe in 74 nights of gillnet effort. In Lake Superior, a combination of bottom trawling, gillnetting, and trapping conducted by Ashland FRO failed to effectively (achieve a minimum reduction of 90% of the ruffe population) reduce the ruffe spawning population in the Ontonagon River Estuary, MI. Totals of 65, 16, and four ruffe were removed in 5.2 hours of trawling effort, 23 nights of trapping effort, and 2.9 hours of gillnetting (30.5 m panel) effort respectively. A bycatch of 62 stocked juvenile lake sturgeon (*Acipenser fulvescens*) were also captured, standard data was recorded, and all sturgeon were released alive. No ruffe were detected in the Lower Great Lakes.

2004; Major ruffe range expansion was detected. Ashland FRO discovered ruffe in Marquette Harbor, MI, Lake Superior,

110 km east of the Sturgeon River Sloughs, Keweenaw Waterway, the previous detected eastern boundary of the ruffe range along the south shore of Lake Superior. The Michigan Department of Natural Resources (MIDNR) discovered ruffe in Big Bay de Noc, Lake Michigan, 15 km east of Little Bay de Noc. Little Bay de Noc was the location of initial discovery of ruffe in Lake Michigan in 2002. Ruffe were not captured from new locations in Lake Huron; however they continue to persist in the Thunder Bay River, MI. Ruffe remain undetected in the Lower Great Lakes, and in all inland lakes and streams within the Great Lakes Basin.

The following report summarizes all reported ruffe surveillance activity outside of the detected range of ruffe in the Great Lakes Basin during 2004.

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OBJECTIVES

The primary objective of ruffe surveillance activities is early detection and description of age and/or size composition. Secondary objectives are to describe the fish community at each location surveyed, and to monitor some interior range locations where ruffe have been previously collected to assess abundance of ruffe and native fish.

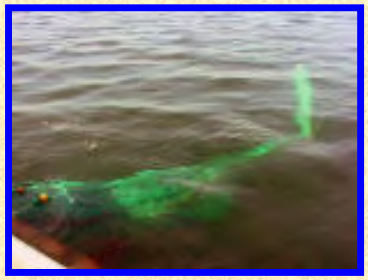
These objectives address the needs of the Ruffe Control Program (Ruffe Control Committee 1996) by defining the range of ruffe and detecting reproducing populations on the periphery of the range. Early detection of range expansion minimizes rate of spread by public awareness, and voluntary ballast water management by the Great Lakes maritime industry.

METHODS

U.S. WATERS OF THE GREAT LAKES

Dedicated surveillance was concentrated in preferred ruffe habitat, primarily defined as areas of turbid water with little light penetration, soft substrate, and average depths from 3-8 meters. These areas included estuaries, embayments, tributary mouths, and canals on the periphery of the ruffe's known range and in or near shipping ports that ruffe could potentially colonize through ballast water from inter- and intra-lake shipping. Most dedicated surveillance was concentrated in the deepest habitat at the site, as determined by electronic depth sounders. This included natural holes or channels in rivers and dredged shipping channels. However, dedicated surveillance was not limited to these areas; shallow areas in rivers and areas with heavy vegetation (sloughs) were also surveyed.

The primary gear used in each of the Great Lakes was a 4.9 m bottom trawl, commercially manufactured with a 3.8 cm stretch mesh body, a 31.8 mm stretch mesh cod end, and a 12.7 mm stretch mesh inner liner to hold small specimens. Bottom trawls were pulled with a variety of vessels and were deployed and retrieved either by hand or with a winch powered hydraulically, electrically, or by gasoline engine. The target time for trawl tows was 5 to 10 minutes per tow, but varied in duration



depending on the size of the area trawled, the presence of submerged obstacles, and numbers of fish captured. Tow speed was maintained at approximately 3 km/hr. and was monitored by commercially manufactured trolling speed indicators or engine tachometer readings.

Bottom water temperature was recorded prior to each trawl tow except when consecutive tows were conducted in close proximity to each other. Depth was recorded at the start and finish of individual tows and then averaged to determine the mean depth for each tow. The mean depths of all tows at a location were averaged to calculate the mean depth at that individual location. Tows were directed along and across contours, but the majority were along contour.

LGLFRO recorded depths at several additional intervals (e.g. 2, 5, and 7 minutes) to determine the mean depth for each tow. Surface temperature, surface and bottom dissolved oxygen levels, and water transparency were also recorded at each location sampled in Lakes Erie and Ontario, (Table 4).

Dedicated surveillance catches were sorted by species and counted, and the total length of up to 50 specimens of each species were measured to the nearest millimeter. All captured species except invasive species (i.e. ruffe, round goby, white perch, tubenose goby (*Proterorhinus marmoratus*), threespine stickleback (*Gasterosteus aculeatus*), fourspine stickleback (*Apeltes quadracus*), common carp (*Cyprinus carpio*), rudd (*Scardinius erythrophthalmus*), rusty crayfish (*Orconectes rusticus*), and sea lamprey (*Petromyzon marinus*) were released. Specimens of unidentified species were retained for later identification.

For age determination, otoliths, the third dorsal spine, and a sample of scales were taken from each captured ruffe. Total length, weight, sex, and maturity were also recorded from individual ruffe specimens.

USFWS-Marquette Biological Station (MBS)-Sea Lamprey Control conducted sea lamprey assessments which provided incidental surveillance information. Assessments were conducted in cooperation with federal, state, and tribal agencies, and private contractors. The gear used in sea lamprey monitoring consisted of portable assessment traps, mechanical traps, and fyke nets. Portable assessment traps were constructed of galvanized steel welded to form a rectangle, 117 cm x 61.4 cm with a funnel at both ends. The steel mesh measured 13 mm square, and the diameter of the funnel entrance holes was 7.6 cm (Schuldt and Heinrich 1982). Mechanical traps were portable (constructed of metal or similar to fyke net) or permanent (constructed of concrete or steel plate) and were usually used in conjunction with a barrier (Schleen et al. 1998).

Cooperation from agency partners and the public continued to expand the coverage and frequency of ruffe surveillance activity. Private anglers continued to report ruffe catches, and agencies and organizations performed incidental ruffe surveillance in conjunction with their primary fish sampling activities. Contributors included USGS-Lake Superior Biological Station, MBS, MIDNR, the Indian Community of Keweenaw Bay, Great Lakes Indian Fish and Wildlife Commission (GLIFWC), Chippewa Ottawa Resource Authority (CORA), National Park Service (NPS), Lake Superior State University (LSSU), Dow Chemical-USA, Grand Traverse Band of Ottawa and Chippewa Indians (GTBOCI), and the Little Traverse Bay Band of Ottawa Indians (LTBBOI).

Public awareness of ruffe continued to be emphasized. Ruffe Watch cards and other information were distributed to harbor-masters, marinas, bait vendors, fishing clubs, motel managers, large variety stores, and hardware stores as well as cooperators and individual private citizens near sampling locations in the Great Lakes. News releases and interviews, information for newsletter articles, and presentations were also conducted or provided.

CANADIAN WATERS OF THE GREAT LAKES

A variety of fishery assessment work is ongoing in the Great Lakes and tributaries that could detect the presence of ruffe. Also, public awareness programs encourage public reporting of ruffe and other invasive species sightings.

In Lake Huron, OMNR completed near-shore (13 sites) and offshore (5 sites) community index programs, angler surveys (5 access points; 6 roving), and a near-shore small fish assessment program (13 sites). Netting programs used gillnets and trapnets in numerous locations throughout the Lake and tributaries.

Access and shore-based creel surveys were conducted in Lake Huron and two tributaries - the Potawatami and Sydenham Rivers. On-board commercial catch sampling was also conducted on 11 vessels in 2004 by OMNR.

In Lake Erie and Lake St. Clair several incidental fish sampling programs took place in 2004. Fisheries and Oceans Canada undertook sampling for a fish biodiversity survey in the Detroit River, St. Clair River, and the Thames River. Gear used included boat electrofishing, seine and hoop nets.

In Lake Ontario, OMNR conducted a number of programs using various gear types. Fisheries and Oceans Canada undertook sampling for a fish biodiversity survey in the St. Lawrence River using boat electrofishing, and seine and hoop nets to capture thousands of fish. They also conducted backpack electrofishing for a fish community assessment of Lynde Creek, Wilmot Creek and Bowmanville Brook, tributaries to Lake Ontario.

OMNR has maintained an awareness program for ruffe and other exotic species in partnership with the Ontario Federation of Anglers and Hunters (OFAH) since 1992. Posters, fact sheets and Ruffe Watch ID packages were distributed at numerous events and meetings throughout 2004 and information was available at www.invadingspecies.com. A waterproof bait-bucket sticker featuring ruffe and three other exotic fishes was also distributed throughout the province. The partnership includes a toll-free Invading Species Hotline (1-800-563-7711) for the public to access information and report new sightings and range expansions of invasive species like ruffe.

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RESULTS

GREAT LAKES BASIN-CANADIAN WATERS

There were no confirmed ruffe reports from the public through the OMNR/OFAH partnership program; several reports of round goby were confirmed in a number of locations throughout the Great Lakes and two inland locations – Trent River and Pefferlaw Brook.

LAKE SUPERIOR

Outside of the documented ruffe range, three seasonal (spring-summer-fall) dedicated surveys were conducted at 5 locations using bottom trawls, and incidental surveys were reported on 75+ locations (Figures 1, 3, 4, and Table 1). Due to slow expansion of ruffe and difficulty in conducting effective monitoring, no dedicated surveillance was conducted in Minnesota waters. However, using an 11.9 m bottom trawl, USGS conducted 30-minute incidental tows in 8 locations along the nearshore waters of Minnesota (Figure 3 and Table 1). No ruffe were captured in these tows. A summary of fish species captured at dedicated locations is available upon request from the Ashland FRO.

Dedicated Surveillance during 2004

Keweenaw Waterway, MI Eighteen species were captured with spottail shiner (*Notropis hudsonius*) dominating the total catch followed by trout-perch (*Percopsis omiscomaycus*), rainbow smelt (*Osmerus mordax*), and yellow perch. A total of three ruffe were collected at two new locations within the Waterway, Pike Bay and South Portage Lake. These consisted of two male yearlings and one female, age 2 (Figure 1 and Table 1). Ruffe were first discovered in the Waterway in 2002.

Pequaming Bay, MI Nine species were captured with ninespine stickleback (*Pungitius pungitius*) and mottled sculpin (*Cottus bairdi*) dominating the total catch (Figure 1 and Table 1). No ruffe were captured.

Marquette Harbor, MI Eleven species were captured with ninespine stickleback comprising the majority of the total catch. One male young-of-the-year ruffe was collected in the lower harbor, the initial discovery at this location. Three other invasive species were collected including 25 threespine stickleback, two zebra mussels (*Dreissena polymorpha*), and Eurasian watermilfoil (*Myriophyllum spicatum*). Threespine stickleback and zebra mussel were previously discovered here (Figure 1 and Table 1).

Munising Bay, MI Eight species were captured with mottled sculpin dominating the total catch. Two other invasive species were collected including 4 threespine stickleback and Eurasian watermilfoil, the initial discoveries at this location (Figure 1 and Table 1). No ruffe were captured.

Grand Marais, MI (West Bay) Eleven species were captured with spottail and emerald shiner (*Notropis atherinoides*), and rainbow smelt dominating the total catch. Two specimens of the invasive threespine stickleback were also collected, the initial discovery at this location (Figure 1 and Table 1). No ruffe were captured.

Incidental Surveillance during 2004

Nearshore Lake Superior USGS-Lake Superior Biological Station conducted bottom trawling at 45 stations outside of the documented ruffe range around Lake Superior to assess spring fish community abundance (Figure 3 and Table 1). The three most common species collected were trout-perch, rainbow smelt, and ninespine stickleback. No ruffe were captured at these stations.

Misery River, MI MBS, GLIFWC, NPS, and private contractors conducted trapping in 9 south shore tributaries outside of the documented ruffe range to assess sea lamprey abundance (Figure 4 and Table 1). No ruffe were captured at these locations, but GLIFWC captured one ruffe from the Misery River, MI, within the documented ruffe range, the initial discovery at this location (Figure 4 and Table 1). A summary of fish species captured in these surveys is archived at MBS.

Keweenaw Waterway, MI Michigan Technological University confirmed a ruffe that an angler had caught in north Portage Lake, a new location within the Waterway (Figure 4 and Table 1). Ruffe were first discovered in the Waterway in 2002.

Keweenaw Bay, MI The Keweenaw Bay Tribal Natural Resources Dept. conducted fish assessments in 7 tributaries to Keweenaw Bay (fall) using backpack electrofishing units, and in lower Keweenaw Bay (summer) using 50 mm stretch mesh gillnets (Figure 4 and Table 1). No ruffe were captured.

Huron Bay, MI The Ashland FRO and the Keweenaw Bay Tribal Natural Resources Dept. conducted a fish assessment over three substrates (cobble, sand, mud) using modified windermere traps, bottom trawling, and experimental gillnets (Figure 4 and Table 1). Three panels of each gillnet consisted of 38, 50, and 63 mm stretch mesh. Twenty-seven species

were captured with longnose dace (*Rhinichthys cataractae*), lake chub, and mottled sculpin the most abundant species captured. No ruffe were captured.

Isle Royale Ashland FRO conducted coaster brook trout assessments at several locations using fyke nets and electrofishing (Figure 4 and Table 1). Surveys were conducted during June and September. The most abundant species captured in this gear were brook trout (*Salvelinus fontinalis*), white sucker (*Catostomus commersoni*), and lake chubs (*Couesius plumbeus*). No ruffe were captured.

Southeastern Lake Superior Ashland FRO conducted lake whitefish assessments at four locations from Grand Marais, MI to Little Lake harbor during July (Figure 4 and Table 1). A portion of the gear consisted of 30.5 m panels of 50 and 62.5 mm stretch mesh gillnet. Seven species were captured in these two mesh sizes with lake trout (*Salvelinus namaycush*), lake herring (*Coregonus artedii*), and round whitefish (*Prosopium cylindraceum*) the most abundant species. No ruffe were captured.

Fisheries and Oceans Canada captured a total of 3,845 fish from all sites sampled, including 276 ruffe and 18 fourspine stickleback from the McKellar and Kaministiquia Rivers (Thunder Bay Harbour area) (Figure 4). Four threespine stickleback were also captured from Thunder Bay Harbour. Ruffe were discovered in Thunder Bay Harbour in 1991.

Unconfirmed Sightings None reported.

LAKE MICHIGAN

Outside of the documented ruffe range (Little Bay de Noc), one dedicated bottom trawl tow was completed at one location, and incidental surveys were reported for 18 locations. One ruffe was captured during an incidental survey in Big Bay de Noc (Figures 1, 4, and Table 2).

Dedicated Surveillance during 2004

Port of Green Bay Six species were collected in the mouth of the Fox River with channel cat (*Ictalurus punctatus*) dominating the catch (Figure 1 and Table 2). Two invasive species were also collected, including three round goby and three white perch. No ruffe were captured.

Incidental Surveillance during 2004

Little Bay de Noc MIDNR captured two mature male ruffe in an experimental gillnet and a mature female ruffe in a bottom trawl while conducting a fishery assessment in June (Figure 4 and Table 2). Ruffe were discovered here in 2002.

Big Bay de Noc MIDNR captured a 4.3 inch female ruffe with developing eggs in a bottom trawl on September 8th while conducting a fishery assessment, the initial discovery here (Figure 4 and Table 2).

Marquette and Ludington Biological Stations in cooperation with the Grand Traverse Band of Ottawa and Chippewa Indians and the Little Traverse Bay Band of Ottawa Indians, the University of Wisconsin-Marinette, and private contractors conducted trapping in 17 tributaries to assess sea lamprey abundance (Figure 4 and Table 2). A summary of fish species captured at these locations is available upon request from MBS. No ruffe were captured in these surveys.

Unconfirmed Sightings A private contractor reported catching a ruffe in a portable assessment trap, while conducting sea lamprey surveillance in Deer Creek, MI (Figure 4). However, the specimen was not kept for confirmation.

LAKE HURON

Dedicated surveys were conducted at 16 locations in U.S. waters. Ruffe were not captured from Lake Huron or the St. Marys River in 2004. (Figure 1 and Table 3).

Dedicated Surveillance during 2004

Alpena FRO completed localized spring surveillance at 3 locations within Thunder Bay and fall surveillance at 15 previously established locations in U.S. waters of Lake Huron and the St. Marys River. Fall sampling was also conducted at one new St. Marys River location at Baie de Wasai.

In the spring, Alpena FRO conducted surveillance at three peripheral locations in Thunder Bay (two canals on Bare Point and around docks at the LaFarge Cement Company) to detect adult ruffe movement into nearby shallow water areas for spawning. Nighttime electrofishing, which has been successfully used to locate ruffe in the Thunder Bay area in past years, was used to sample these locations during May. No ruffe were captured (Table 3). A concentrated effort to remove spawning phase adult ruffe was conducted in known spawning areas of the Thunder Bay River with small-mesh gillnets. The effort was initiated in 2002, with 2004 being the third consecutive year targeting spawning ruffe in the Thunder Bay River. These efforts sampled deep channels adjacent to shallow areas where ruffe had been captured in the past years. No ruffe were captured following 94 nights of gillnet effort (Table 3).

Alternative gear was also used to detect ruffe that may be present in known spawning areas including small-mesh trapnets, which were fished adjacent to gillnets for a short period of time during the spawning season, and nighttime electrofishing. No ruffe were captured following 6 nights of trap effort.

In the fall, Alpena FRO completed surveillance at 15 established locations in U.S. waters of Lake Huron and the St. Marys River, and at one new site in the St. Marys River (Figure 1) during September and October. Bottom trawls were used in all surveys, which targeted deep water shipping channels and river mouths. In addition, small-mesh gillnets were used in the Thunder Bay River for comparison to spring removal efforts. Round goby was the most abundant species captured from the Thunder Bay River, and comprised 52% of the total catch from this location.

Thirty-two species were represented in the total trawl catch from all locations. Round goby were the most abundant species at 6 of the locations where found and 2nd in abundance at the remaining 2 locations. Round goby were also the most abundant species captured overall (32% of the total catch), followed by yellow perch (12% of total catch). No ruffe were captured during trawling or gillnet efforts in the Thunder Bay area or any other location (Table 3). A summary of fish species captured in all surveyed locations is available upon request from Alpena FRO.

Incidental Surveillance during 2004

MBS, in cooperation with CORA, Dow Chemical-USA, LSSU, and private contractors, conducted trapping in 13 tributaries to assess sea lamprey abundance (Figure 4 and Table 3). No ruffe were captured in these surveys. A summary of fish species captured at these locations is available upon request from MBS.

OMNR sampled a total of 139,415 fish, including 2,116 round goby. No ruffe were captured.

Unconfirmed Sightings None reported.

LAKE ERIE

Dedicated surveys were conducted at seven locations, and incidental surveys were reported for three locations in U.S. waters (Figures 2, 5, and Table 4). No ruffe were captured in any of these surveys.

Dedicated Surveillance during 2004

The Lower Great Lakes FRO completed bottom trawl surveys at seven previously established locations including Ashtabula, Buffalo, Cleveland, Conneaut, Erie, Sandusky, and Toledo. All sites were surveyed twice, during June and September, except Toledo and Erie. Toledo was surveyed during July and September due to flood-stage conditions of the Maumee River in June. Erie was surveyed only in September due to poor weather in June (Figure 2 and Table 4). The summer catch was comprised of 11 different species, of which five species made up 89% of the catch: Channel catfish (31%), freshwater drum (32%), round goby (10%), white perch (9%), and rainbow smelt (7%). The fall survey yielded 16 different species, of which five species made up 83% of the total catch: white perch (32%), freshwater drum (21%), channel catfish (12%), trout-perch (9%), round goby (9%).

A summary of fish species captured at these locations is available upon request from the LGLFRO. No ruffe were captured in either survey. A summary of fish species captured at these locations is available upon request from LGLFRO.

Incidental Surveillance during 2004

MBS and private contractors conducted trapping in three tributaries to assess sea lamprey abundance (Figure 5 and Table 4). No ruffe were captured. A summary of fish species captured at these locations is available upon request from MBS.

Fisheries and Oceans Canada sampled thousands of fish, including the capture of tubenose goby from the St Clair River; and round goby from the St Clair and Detroit Rivers (Figure 5). No ruffe were captured.

Unconfirmed Sightings None reported.

LAKE ONTARIO

Dedicated surveys were conducted at one location, and incidental surveys were reported for six locations in U.S. waters (Figures 2, 5, and Table 4). No ruffe were captured.

Dedicated Surveillance during 2004

The Lower Great Lakes FRO conducted bottom trawl surveys in Rochester Harbor, NY, at the mouth of the Genessee River. The transects are located within the dredged shipping channel 3 km upstream from the lake, and they were surveyed during June and September (Figure 2 and Table 4). No fish were captured in the June survey. The September catch consisted of five species, and channel catfish, comprised 67% of the total catch. The remainder of the catch consisted of emerald shiner (8%), spottail shiner (8%), trout-perch (8%), and lake sturgeon (8%). No ruffe were captured.
Incidental Surveillance during 2004

Genessee River The Lower Great Lakes FRO conducted one bottom trawl survey in September to monitor downstream migration of stocked juvenile lake sturgeon (Figure 5 and Table 4). No fish were captured.

MBS contracted with private contractors to conduct trapping in five tributaries to assess sea lamprey abundance (Figure 5 and Table 4). No ruffe were captured. A summary of fish species captured at these locations is available upon request from MBS.

Fisheries and Oceans Canada conducted a fish community assessment of three tributary streams sampling over 8,500 fish. Round goby was detected in Soper Brook, a tributary of Bowmanville Creek. No ruffe were captured.

Unconfirmed Sightings None reported.

SUMMARY

Range expansion of Eurasian ruffe was detected in Lake Superior and Lake Michigan during 2004. One young-of-the-year ruffe was captured in Marquette Harbor, MI, which extends their range 110 km (69 miles) east along the south shore of Lake Superior. One mature female ruffe was captured in Big Bay de Noc, Lake Michigan, 15 km (10 miles) east of Little Bay de Noc, where ruffe were first detected in 2002. Ruffe expansion was also detected in two tributaries of Lake Superior within the documented ruffe range, the Keweenaw Waterway, MI, and the Misery River, MI. No ruffe were captured from Lake Huron. Ruffe continue to be undocumented in Lake Erie, Lake Ontario, and in all inland lakes and streams in the Great Lakes Basin.

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DISCUSSION

Lake Superior

Given that four ruffe were captured in the Keweenaw Waterway in spawning condition, it is likely that ruffe reproduction is occurring in the Keweenaw Waterway. One of the four ruffe was a developing female, age two. Two other captured ruffe were ripe males, age one, captured approximately 3 km from the female ruffe. With one ruffe captured in the Misery River halfway between the Ontonagon River and the Keweenaw Waterway, there is also evidence to suggest the ruffe population in the Keweenaw Waterway is being reinforced by the Ontonagon River ruffe population.

The source of the young-of-the-year ruffe collected during fall surveillance in Marquette Harbor is unknown. Although some oreboats do discharge ballast in Marquette, none are known to take on that ballast in ruffe infested waters. No ruffe were captured during the spring and summer dedicated surveys in Marquette, which suggests that a large reproducing population does not exist. Continuing dedicated surveillance in Marquette Harbor should verify the status of ruffe there.

Lake Huron

Within the Thunder Bay area, the absence of young-of-the-year ruffe from fall trawling surveys from 2001 to present, and the decline in spring adult spawning ruffe captured in gillnets from 2002 to 2003 followed by the absence of ruffe in 2004 suggests an overall decline in the Lake Huron ruffe population. The absence of young-of-the-year was an initial sign that recruitment may not be taking place, and the more recent decline and absence of spawning adults also suggests that any recruitment was insufficient to foster the population. It is unknown why the large abundance of ruffe captured in 1999 (470 ruffe), an 11 fold increase in abundance over the 1998 catch, did not transfer into a large catch of adult or subsequent young-of-the-year in 2000. One reason may be the colonization and subsequent flourishing of the round goby in the Thunder Bay area. The round goby was first captured from the Thunder Bay River in 1999, and although their abundance was low that year (14% of total catch), they became the most abundant species captured from the river during the following year, a status which has continued. Round goby are known egg feeders, can spawn multiple times in a season, guard their nests to ensure the development of their young, and are very aggressive. Although direct interactions are unknown between goby and ruffe, we surmise that goby may be feeding on ruffe eggs and/or young that were deposited and/or hatched in the river in the spring and early summer, or that goby may be having some other negative effect on

ruffe. Following 2000, ruffe were not captured from the Thunder Bay River or adjacent waters in fall trawling surveys, however, round goby were the most abundant species captured from these waters during fall trawling surveys conducted through 2002 and in 2004.

Although young-of-the-year ruffe have not been captured from the Thunder Bay River in the fall since 2001, adult spawning phase ruffe have been captured during the spring. Alpena FRO initiated a spring reduction effort in 2002 to remove adult spawning ruffe prior to reproduction using gillnets. The catch of adults declined from 2002 (96 ruffe) to 2003 (10 ruffe) and no ruffe were captured in 2004. It may be that the removal of spawning adults, coupled with other events, possibly predation effects caused by the round goby, may be contributing to the decline in ruffe numbers. Although ruffe were not captured from the Thunder Bay area in 2004, spring removal and fall surveillance efforts will continue in 2005. Large scale surveillance efforts at ports and tributaries to Lake Huron and the St. Marys River will continue in 2005 as well.

Lake Michigan

With ruffe expanding outside of Little Bay de Noc into neighboring Big Bay de Noc, it is likely that ruffe abundance is continuing to increase in northern Green Bay. MIDNR captured a ruffe at a location in Little Bay de Noc where none had been captured before. However, given the potential for round goby impact on ruffe recruitment, ruffe expansion in Lake Michigan may slow, unless ruffe discover niches that are essentially void of gobies.

How Successful Is Ruffe Range Expansion Being Delayed in the Great Lakes

The U.S. Geological Survey projected future unassisted range expansion of ruffe based on lake currents and U.S. documented ruffe range expansion through 1994 (unpublished data, U.S.G.S., Great Lakes Science Center, Lake Superior Biological Station). In Lake Superior, USGS projected 2002 as the most likely year of ruffe arrival in the Keweenaw Waterway, MI, and 2006 as the most likely year of ruffe arrival in Marquette, MI. Documented arrival of ruffe in the Keweenaw Waterway was 2002, and Marquette was 2004. In Lake Huron, the most likely year of ruffe arrival in Saginaw Bay was projected to be 2003. Surveillance has not documented the presence of ruffe in Saginaw Bay, or any other location in Lake Huron other than Thunder Bay near Alpena, 93 km north of Saginaw Bay. In Lake Michigan, ruffe were projected to likely arrive in Manistique, MI by 2007. Ruffe were documented to arrive in Big Bay de Noc in 2004, 50 km southwest of Manistique. Voluntary ballast exchange conducted by the Lake Carriers Association, educational efforts conducted by Sea Grant and state, tribal, and federal environmental organizations, and range monitoring documented by surveillance, have significantly reduced the potential of human assisted ruffe range expansion. It appears that ruffe are expanding their range very close to unassisted range expansion projections.

Range of Ruffe

The current range of ruffe in the Great Lakes is as follows (see range map):

Lake Superior

From the Duluth/Superior harbor: extending along the north shore to the Current River, Thunder Bay Harbour, ON, Canada; and extending along the south shore to Marquette Harbor, MI.

Lake Huron

Thunder Bay River & Thunder Bay Shipping Channel near Alpena, MI.

Lake Michigan

Little Bay de Noc and Big Bay de Noc of Green Bay.

Lake Erie

Unconfirmed.

Lake Ontario
Not Observed.

Proposed Surveillance in 2005

Lake Superior

Ashland FRO will continue to monitor for presence and abundance of ruffe, other invasive species, and native species at established stations near the periphery and outside of the documented ruffe range in U.S. waters. Surveys are planned for spring and fall. Within the periphery of the ruffe range, the locations include southern Keweenaw Waterway, Pequaming Bay, and Marquette Harbor. Outside of the ruffe range, the locations include Munising Bay, Grand Marais (West Bay), and the Tahquamenon River Estuary, a tributary in western Whitefish Bay. Lake Michigan No dedicated surveillance is scheduled.

Lake Huron

Alpena FRO will continue dedicated ruffe surveillance at selected Michigan tributaries, nearshore areas, and ports in U.S. waters of Lake Huron and the St. Marys River. Surveillance is planned for September and October at four St. Marys River locations and seven Lake Huron locations. An additional location at Port Austin may be added if budget allows.

Lakes Erie and Ontario

LGLFRO plans to continue surveillance in dredged channels adjacent to harbors in U.S. waters of Lakes Erie and Ontario. These surveys will be conducted at Toledo, Sandusky, Cleveland, Ashtabula, Conneaut, Erie, and Buffalo in Lake Erie, and the Genessee River (near Rochester) in Lake Ontario. Incidental surveillance for ruffe is also planned for the Genessee River during juvenile lake sturgeon monitoring. LGLFRO will continue to respond to angler reports of ruffe sightings.

Surveillance in additional waterways will be conducted as considered appropriate (e.g. to follow-up unconfirmed sightings and/or new reported discoveries).

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SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2004

Figure 1. Dedicated locations surveyed for ruffe in the Upper Great Lakes, 2004.

1. Thunder Bay Harbour*

10. Port Dolomite

19. Saginaw River (Mouth)

2. Keweenaw Waterway (S. Entry) *

3. Pequaming Bay

4. Huron Bay

5. Upper Marquette Harbor

6. Lower Marquette Harbor**

7. Munising Bay

8. West Bay (Grand Marais)

9. Port of Green Bay

11. Cheboygan River

12. Thunder Bay (LaFarge)

13. Thunder Bay River

14. Thunder Bay (River Ship. Channel)

15. Thunder Bay (Bare Point)

16. Thunder Bay

17. National Gypsum

18. Au Gres River

20. Saginaw River (Carrollton)

21. Harbor Beach

22. St. Marys River (De Tour Passage)

23. St. Marys River (Munuscong Channel)

24. St. Marys River (South Sugar Island Ferry)

25. St. Marys River (Baie de Wasi)

26. St. Marys River (SSM Municipal Harbor)

27. St. Marys River (Above Locks)

***Locations where ruffe were captured**

****New ruffe discovery**

SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2004

Figure 2. Dedicated locations surveyed for ruffe in U.S. waters of the Lower Great Lakes, 2004.

SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2004

USGS-Great Lakes Science Center-Lake Superior Biological Station

Figure 3. Incidental Locations surveyed for ruffe in the nearshore waters of Lake Superior, 2004.

SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2004

Figure 4. Reported incidental locations surveyed for ruffe in the Upper Great Lakes, 2004.

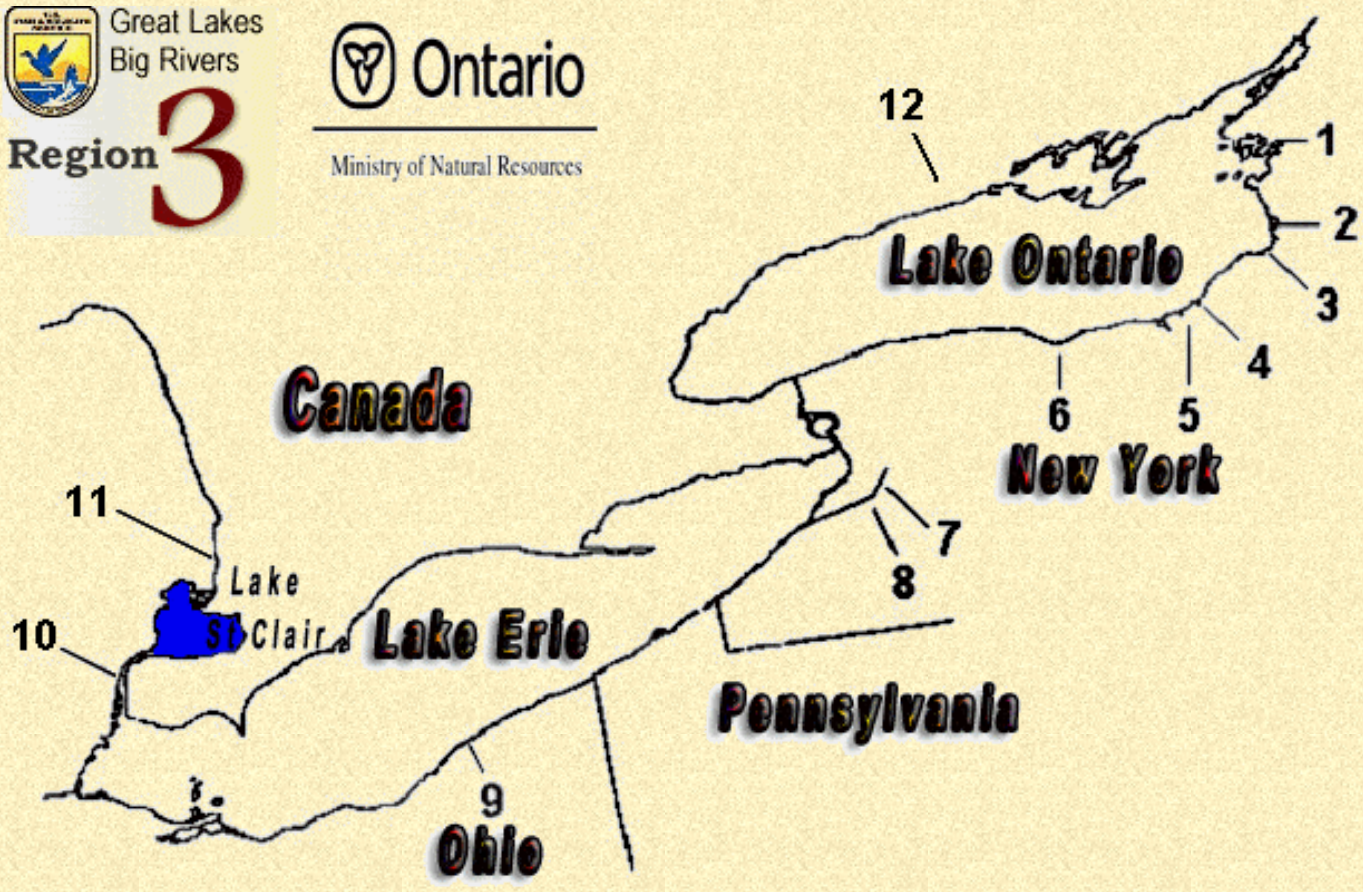
1. Misery River**
2. Kelsey Creek
14. Grand Marais
15. Blind Sucker
27. Menominee River
28. Peshtigo River
40. Carp River
41. St. Marys River

3. Falls River
4. Little Silver Creek
5. Silver River
6. Slate River
7. Keweenaw Bay
8. Big Garlic River
9. Chocolay River
10. Laughing Whitefish River
11. Rock River
12. Furnace Creek
13. Miners River
16. Deer Park
17. Little Lake Harbor
18. Betsy River
19. Tahquamenon River
20. Isle Royale
21. Thunder Bay Harbour*
22. Hog Island Creek
23. Manistique River
24. Ogontz River
25. Big Bay de Noc**
26. Little Bay de Noc*
29. Oconto River
30. East Twin River
31. St. Joseph River
32. Muskegon River
33. Pere Marquette River
34. Little Manistee River
35. Betsie River
36. Boardman River
37. Deer Creek
38. Jordan River
39. Carp Lake Outlet
42. Albany Creek
43. Trout Creek
44. Nunns Creek
45. Cheboygan River
46. Ocqueoc River
47. Trout River
48. Swan River
49. Devils River
50. AuSable River
51. East AuGres River
52. Tittabawassee River

*** Locations where ruffe were captured**
**** New ruffe discovery**

SURVEILLANCE FOR RUFFE IN THE GREAT LAKES, 2004

Figure 5. Reported incidental locations surveyed for ruffe in the Lower Great Lakes, 2004.



1. Black River
2. Grindstone Creek
3. Little Salmon River
7. Cattaraugus Creek
8. Spooner Creek
9. Grand River

4. Sterling Creek

5. Sterling Valley Creek

6. Genessee River

10. Detroit River

11. St Clair River

12. Soper Brook

Table 1. Summary of 2004 ruffe surveillance efforts in Lake Superior.

Location	Agency	Effort *	Gear	Date	Ave. Btm. Temp (°C)	Ave. Depth (m)	Ave. Secchi (m)	RUFFE
Lake Superior (Dedicated Surveillance)								
Keweenaw Waterway (North Entry)	FWS	64	BT-4.9	5/8/04	7.6	6.8	2.1	
Keweenaw Waterway (Pike Bay)***	FWS	7	BT-4.9	5/9/04	10.4	3.8	0.9	1
Keweenaw Waterway (Pike Bay)	FWS	15	BT-4.9	8/2/04	23.5	4.8	1.9	
Keweenaw Waterway (S. Portage Lake)***	FWS	5	BT-4.9	5/9/04	8.9	8.2	1.2	2
Keweenaw Waterway (South Entry)	FWS	25	BT-4.9	8/3/04	23.3	5.9	1.7	
Eagle Harbor	FWS	16	BT-4.9	10/5/04	10.0	1.6	2.6	
Pequaming Bay	FWS	15	BT-4.9	5/10/04	4.5	11.5	3.4+	
Pequaming Bay	FWS	30.5	BT-4.9	8/4/04	18.0	10.0	8.0	
Pequaming Bay	FWS	10	BT-4.9	10/4/04	11.0	9.1	6.7	
Marquette Lower Harbor	FWS	23	BT-4.9	5/10-11/04	6.6	8.5	3.4+	
Marquette Lower Harbor	FWS	24	BT-4.9	8/5/04	18.0	8.1	7.6	
Marquette Lower Harbor***	FWS	24	BT-4.9	10/6/04	12.0	8.5	5.7	1
Marquette Upper Harbor	FWS	28	BT-4.9	5/11/04	5.9	9.4	3.4+	
Marquette Upper Harbor	FWS	20	BT-4.9	8/5/04	18.0	6.9	5.6	
Marquette Upper Harbor	FWS	20	BT-4.9	10/6/04	13.0	10.3	8.5	
Munising Bay	FWS	21	BT-4.9	5/11/04	5.8	10.6	3.4+	
Munising Bay	FWS	15	BT-4.9	8/6/04	20.0	9.9	8.2	
Munising Bay	FWS	25	BT-4.9	10/7/04	12.0	10.0	6.1	
Grand Marais (West Bay)	FWS	22.5	BT-4.9	5/12/04	8.2	9.4	2.8	
Grand Marais (West Bay)	FWS	26	BT-4.9	8/7/04	18.0	10.2	8.0	
Grand Marais (West Bay)	FWS	24	BT-4.9	10/8/04	12.0	10.7	1.6	
		Hours						**RUFFE**
TOTALS		7.67	BT-4.9					**4**
		Total Ruffe (Dedicated Surveillance)						4
Lake Superior (Incidental Surveillance)								
Betsy River	FWS	110 trapnights	PAT	5/4-6/28/04	14.8	0.5		
Big Garlic River	PC	56 trapnights	FN	5/1-6/26/04	14.2	0.5-1.0		
Chocolay River	PC	56 trapnights	FN	5/1-6/26/04	11.9	0.5-1.0		
Falls River	KB	0.3 hours	BPEL	10/14/04				
Furnace Creek	PC	114 trapnights	FN/PAT	4/29-6/26/04	13	0.5-1.0		
Grand Marais	FWS	1,372 meters	GN-50	7/20-22, 25-26,28-29/04	14	44.3		
Grand Marais	FWS	1,860 meters	GN-63	7/20-22, 25-26,28-29/04	14	41.3		
Isle Royale	FWS		BPEL	9/10-14/04	14			
Isle Royale	FWS		BEL	6/4-6/04	10.5			
Isle Royale	FWS	20 trapnights	FN	6/5-7/04	10	1.3		
Kelsey Creek	KB	0.5 hours	BPEL	10/5/04				
Keweenaw Bay	KB	1,296 meters	GN-50	7/26-28;8/3-4,16-17/04	19	40.5		
Keweenaw Waterway (N. Portage Lake)***	PA		HL	summer, 2004				1
Laughing Whitefish River	PC	56 trapnights	FN	5/1-6/26/04	11.9	0.5-1.0		
Little Silver Creek	KB	0.9 hours	BPEL	10/5/04				
Menge Creek	KB	0.7 hours	BPEL	10/5/04				
Miners River	NPS/FWS	136 trapnights	PAT	5/3-7/10/04	12.2	0.5		
Misery River***	GLIFWC	152 trapnights	PAT	5/7-7/22/04	15.3	0.5		1
Nearshore Lake Superior	USGS	1350	BT-11.9	5/11-6/19/04		77.5		
Ravine River	KB	0.5 hours	BPEL	10/13/04				
Rock River	FWS	130 trapnights	PAT	5/3-7/7/04	12.7	0.5		
Silver River	GLIFWC	75 trapnights	FN	5/7-7/21/04	16.2	0.5-1.0		
Silver River	KB	0.8 hours	BPEL	10/14/04				
Slate River	KB	0.4 hours	BPEL	10/13/04				
Tahquamenon River	FWS	171 trapnights	PAT	5/3-6/29/04	14.6	0.5		
								RUFFE
Totals			HL					**1**
		1076 trapnights	Traps					**1**
			BEL					**0**
		4.1 hours	BPEL					**0**
		22.5 hours	BT-11.9					**0**
		Total Ruffe (Incidental Surveillance)						**2**
		Total Ruffe (Dedicated Surveillance)						**4**
		Total Ruffe (All Surveillance)						**6**

Key to Agency:
FWS = U.S. Fish & Wildlife Service
GLIFWC = Great Lakes Indian Fish & Wildlife Commission
KB = Keweenaw Bay Tribal Natural Resources Dept.
PC = Private Contractor
USGS = U.S. Geological Survey
NPS = National Park Service
PA = Private Angler

Key to Gear:
BT-4.9 = 4.9m Bottom Trawl
BT-11.9 = 11.9m Bottom Trawl
BEL = Boom Electrofishing
BPEL = Backpack Electrofishing
FN = Fyke Net
PAT = Portable Assessment Trap
GN-50 = Gill Net (50 mm stretch mesh)
GN-63 = Gill Net (62.5 mm stretch mesh)
HL = Hook & Line

* Unless specified, effort is in minutes trawl was on bottom.
** Locations where ruffe were captured.
*** New ruffe discovery

Table 2. Summary of 2004 ruffe surveillance efforts in Lake Michigan.

Location	Agency	Effort *	Gear	Date	Ave. Btm. Temp (°C)	Ave. Depth (m)	RUFFE
Lake Michigan (Dedicated Surveillance)							
Port of Green Bay (Fox River)	FWS	5	BT-4.9	8/31/04	23.0	7.3	
							RUFFE
TOTALS		0.1 hours	BT-4.9				**0**
		Total Ruffe (Dedicated Surveillance)					**0**
Lake Michigan (Incidental Surveillance)							
Betsie River	GTB	142 trapnights	PAT	4/13-6/23/04	15.1	UNK	
Big Bay de Noc	MIDNR	50	BT	6/17/04			
Big Bay de Noc	MIDNR	250 Feet	GN	6/17/04		3.0	
Big Bay de Noc	MIDNR	250 Feet	GN	6/17/04		6.0	
Big Bay de Noc***	MIDNR	30	BT	9/8/04			1
Big Manistee River	PC	114 trapnights	PAT	4/15-6/11/04	12.9	0.5	
Boardman River	GTB	144 trapnights	PAT	4/12-6/23/04	14.5	0.5	
Carp Lake Outlet	LTBBOI	45 trapnights	PT	5/11-6/25/04	16.2	0.8	
Deer Creek	PC	124 trapnights	PAT	4/15-6/16/04	15.2	0.5	
East Twin River	PC	58 trapnights	PAT	4/21-6/18/04	17.0	0.5	
Hog Island Creek	PC	66 trapnights	FN	4/19-6/24/04	10.8	0.5-1.0	
Jordan River	PC	134 trapnights	FN	3/9-7/21/04	10.3	1.0	
Little Bay de Noc**	MIDNR	50	BT	6/17/04			1
Little Bay de Noc**	MIDNR	250 Feet	GN	6/17/04		3.0	2
Little Bay de Noc	MIDNR	250 Feet	GN	6/17/04		6.0	
Little Manistee River	FWS/MBS	138 trapnights	PAT	4/15-6/23/04	14.2	UNK	
Manistique River	FWS/MBS	42 trapnights	MT	5/7-6/18/04	15.0	0.3	
Menominee River	UW-M	56 trapnights	PAT	4/23-6/18/04	15.2	UNK	
Muskegon River	PC	54 trapnights	PAT	4/17-6/10/04	13.9	UNK	
Oconto River	UW-M	58 trapnights	PAT	4/21-6/18/04	16.0	UNK	
Ogontz River	PC	57 trapnights	FN	4/29-6/25/04	12.6	0.5-1.0	
Pere Marquette River	FWS/LBS	70 trapnights	PT	3/24-6/2/04	11.6	UNK	
Peshtigo River	UW-M	112 trapnights	PAT	4/23-6/18/04	16.5	UNK	
St. Joseph River	PC	140 trapnights	PAT	3/12-5/21/04	15.3	0.5	
							RUFFE
TOTALS		257 trapnights	FN				**0**
		1297 trapnights	Traps				**0**
		2.2 Hrs.	BT				**2**
		1000 Feet	GN				**2**
		Total Ruffe (Incidental Surveillance)					**4**
		Total Ruffe (Dedicated Surveillance)					**0**
		Total Ruffe (All Surveillance)					**4**

Key to Agency:
FWS = U.S. Fish & Wildlife Service
MIDNR = Michigan Dept. of Natural Resources
PC = Private Contractor
GTB = Grand Traverse Band of Ottawa and Chippewa Indians
UW-M = University of Wisconsin-Marinette
MBS = Marquette Biological Station
LBS = Ludington Biological Station
LTBBOI = Little Traverse Bay Band of Ottawa Indians

Key to Gear:
GN = Gillnet
BT = Bottom trawl
BT-4.9 = 4.9m Bottom Trawl
PT = Permanent Trap
MT = Mechanical Trap
PAT = Portable Assessment Trap
FN = Fyke Net

UNK = Unknown
* Unless specified, effort is in minutes trawl was on bottom.
**Locations where ruffe were captured
***New ruffe discovery

Table 3. Summary of 2004 ruffe surveillance efforts in U.S. waters of Lake Huron.

Location	Agency	Effort *	Gear	Date	Ave. Btm. Temp (°C)	Ave. Depth (m)	RUFFE
Lake Huron (Dedicated Surveillance)							
AuGres River	FWS	30.0	BT-4.9	9/23/04	2.8	22.0	
Cheboygan River	FWS	31.0	BT-4.9	10/19/04	7.5	10.3	
Harbor Beach	FWS	40.0	BT-4.9	9/22/04	4.6	16.5	
National Gypsum	FWS	30.0	BT-4.9	9/24/04	6.4	19.2	
Port Dolomite	FWS	30.5	BT-4.9	10/13/04	8.3	7.9	
Saginaw River (Mouth)	FWS	30.0	BT-4.9	9/23/04	8.7	19.9	
Saginaw River (Carrollton)	FWS	35.0	BT-4.9	9/21/04	7.1	20.8	
St. Marys River (Above Locks)	FWS	30.5	BT-4.9	9/8/04	9.6	16.8	
St. Marys River (SSM Municipal Harbor)	FWS	30.5	BT-4.9	9/8-9/04	4.3	17.1	
St. Marys River (South Sugar Island Ferry)	FWS	31.0	BT-4.9	9/7/04	6.6	17.3	
St. Marys River (Baie de Wasi)	FWS	5.5	BT-4.9	9/7/04	5.2	17.3	
St. Marys River (Munuscong Channel)	FWS	25.5	BT-4.9	9/8/04	5.8	17.6	
St. Marys River (De Tour Passage)	FWS	30.0	BT-4.9	9/9/04	7.7	17.8	
Thunder Bay	FWS	17.5	BEL	5/11-12/04	1.5	16.6	
Thunder Bay (Bare Point)	FWS	90.0	BEL	5/20/04	1.4	14.0	
Thunder Bay (LaFarge Cement)	FWS	32.0	BEL	5/11-12/04	2.1	16.6	
Thunder Bay (River Shipping Channel)	FWS	31.5	BT-4.9	10/12/04	6.4	13.4	
Thunder Bay River	FWS	46.0	BT-4.9	9/14 & 10/12/04	6.1	19.2	
Thunder Bay River	FWS	94 nights	GN	3/24-5/21/04	3.5	9.0	
Thunder Bay River	FWS	16 nights	GN	10/4-8/04	3.2	13.8	
Thunder Bay River	FWS	6 trapnights	TN	5/4-7/04	2.7	10.1	
Thunder Bay River	FWS	44.5	BEL	5/11-12/04	1.5	16.6	
							RUFFE
TOTALS		7.6 hours	BT-4.9				**0**
		82 nights	GN				**0**
		6 trapnights	TN				**0**
		3.1 hours	ELE				**0**
		Total Ruffe (Dedicated Surveillance)					**0**
Lake Huron (Incidental Surveillance)							
Albany Creek	CORA	60 trapnights	PAT	4/26-6/25/04	10.1	0.5	
AuSable River	PC	120 trapnights	PAT	4/20-6/19/04	11.8	UNK	
Carp River	CORA	186 trapnights	FN	4/27-6/28/04	11.2	0.5-1.0	
Cheboygan River	FWS/MBS	196 trapnights	PT/PAT	5/7-6/25/04	15.0	1.0	
Devils River	PC	59 trapnights	FN	4/21-6/19/04	15.3	0.5-1.0	
East AuGres River	PC	53 trapnights	PAT	4/20-6/12/04	11.4	UNK	
Nunns Creek	CORA	56 trapnights	PAT	4/26-6/21/04	8.7	0.5	
Ocqueoc River	FWS/MBS	96 trapnights	MT	5/11-6/28/04	16.4	0.4	
St. Marys River	LSSU/MBS	432 trapnights	PAT	6/10-8/3/04	13.1	UNK	
Swan River	FWS/MBS	40 trapnights	FN	5/4-6/13/04	14.3	0.5-1.0	
Tittabawassee River	DC	32 trapnights	MT	4/30-6/1/04	13.8	0.3-0.5	
Trout Creek	CORA	53 trapnights	FN	4/26-6/18/04	12.1	0.5-1.0	
Trout River	FWS/MBS	47 trapnights	MT	5/13-6/29/04	15.3	0.2	
							RUFFE
TOTALS		338 trapnights	FN				**0**
		1092 trapnights	Traps				**0**
		Total Ruffe (Incidental Surveillance)					**0**
		Total Ruffe (Dedicated Surveillance)					**0**
		Total Ruffe (All Surveillance)					**0**

Key to Agency:
FWS = U.S. Fish & Wildlife Service
MBS = Marquette Biological Station
CORA = Chippewa Ottawa Resource Authority
LSSU = Lake Superior State University
DC = Dow Chemical-USA
PC = Private Contractor
UNK = Unknown

Key to Gear:
BT-4.9 = 4.9m Bottom Trawl
GN-38 = Gill Net (37.5mm stretch mesh)
TN = Trapnet (37.5mm stretch mesh)
FN = Fyke Net
PAT = Portable Assessment Trap
MT = Mechanical Trap
BEL = Boom Electrofishing

* Unless specified, effort is in minutes trawl was on bottom.
** Locations where ruffe were captured.

Table 4. Summary of 2004 ruffe surveillance efforts in the Lower Great Lakes.

Location	Agency	Effort*	Gear	Date	Depth (m)	Sf. Temp. (C)	Bt. Temp. (C)	Sf. DO (ppm)	Bt. DO (ppm)	Secchi (m)	RUFFE
Lake Erie (Dedicated Surveillance)											
Ashtabula Harbor	FWS	42.2	BT-4.9	6/17/04	9.3	20.0	18.0	8.5	8.7	1.2	
Ashtabula Harbor	FWS	43.8	BT-4.9	9/16/04	8.9	20.6	20.5	5.3	5.3	1.2	
Buffalo Harbor	FWS	46.7	BT-4.9	6/24/04	7.6	20.0	24.0	6.3	6.9	1.9	
Buffalo Harbor	FWS	44.7	BT-4.9	9/10/04	7.5	21.0	20.8	6.1	6.0	3.4	
Cleveland Harbor	FWS	66.5	BT-4.9	6/16/04	8.2	21.9	20.3	7.2	6.5	0.4	
Cleveland Harbor	FWS	67.9	BT-4.9	9/15/04	8.0	21.7	21.6	5.5	5.5	0.8	
Conneaut Harbor	FWS	34.8	BT-4.9	6/17/04	8.6	22.4	17.7	8.1	8.6	1.0	
Conneaut Harbor	FWS	33.3	BT-4.9	9/16/04	8.6	20.8	20.5	5.9	5.7	0.9	
**Erie Harbor	FWS	40.4	BT-4.9	9/1/04	7.4	23.7	22.7	2.8	3.0	1.5	
Sandusky Harbor	FWS	30.8	BT-4.9	6/14/04	7.4	22.5	21.2	9.8	7.2	0.4	
Sandusky Harbor	FWS	35.1	BT-4.9	9/13/04	7.4	22.7	21.5	8.1	5.9	0.7	
***Maumee River	FWS	4.4	BT-4.9	6/15/04	-	-	-	-	-	-	
***Maumee River	FWS	47.2	BT-4.9	7/29/04	8.5	22.8	21.2	5.0	5.5	0.2	
Maumee River	FWS	44.0	BT-4.9	9/14/04	8.6	22.6	22.3	4.4	4.0	0.2	
		Hours									**RUFFE**
TOTALS		9.70	BT-4.9								**0**
Lake Erie (Incidental Surveillance)											
Cattaraugus Creek	PC	116 trapnights	PAT	5/5-7/2/04	0.5	15.9					
Grand River	PC	126 trapnights	PAT	4/8-6/10/04	0.5	18.3					
Spooner Creek	PC	116 trapnights	PAT	5/5-7/2/04	0.5	13.3					
											RUFFE
TOTALS		358 trapnights	PAT								**0**
Lake Ontario (Dedicated Surveillance)											
Genesee River	FWS	31.3	BT-4.9	6/10/04	6.3	19.3	19.3	9.6	9.4	0.3	
Genesee River	FWS	31.9	BT-4.9	9/29/04	6.3	17.2	17.2	3.8	4.1	0.2	
		Hours									**RUFFE**
TOTALS		1.1	BT-4.9								**0**
Lake Ontario (Incidental Surveillance)											
Genessee River	FWS	6.8	BT-4.9	9/29/2004	6.3	17.3	17.3	2.4	2.5	0.2	
Black River	PC	177 trapnights	PAT	4/10-6/8/04	UNK	11.4					
Grindstone Creek	PC	54 trapnights	PAT	4/11-6/4/04	0.5	15.4					
Little Salmon River	PC	54 trapnights	PAT	4/11-6/4/04	UNK	15.4					
Sterling Creek	PC	55 trapnights	PAT	4/10-6/4/04	0.5	16.3					
Sterling Valley Creek	PC	55 trapnights	PAT	4/10-6/4/04	0.5-1.0	15.7					
											RUFFE
TOTALS		.11 hours	BT-4.9								**0**
		395 trapnights	**PAT**								**0**
		Total Ruffe (All Surveillance)									**0**

Key to Column Headings: Sf. Temp = Surface Temperature; Sf. DO = Surface Dissolved Oxygen; Bt. Temp. = Bottom Temperature; Bt. DO = Bottom Dissolved Oxygen

Key to Agency: FWS = U.S. Fish & Wildlife Service; PC = Private Contractor

Key to Gear: BT-4.9 = 4.9m Bottom Trawl; PAT = Portable Assessment Trap

UNK = Unknown

* Unless specified, effort is in minutes trawl was on bottom.

**Erie Harbor not completed during June survey due to weather

***Maumee River attempted, but not completed during June survey due to flood stage conditions - re-surveyed and completed on 7/29/2004.

Confirmed Ruffe Sightings

(Gymnocephalus cernuus)

Lake Superior

1. St. Louis River, 1986
2. Amnicon River, 1988
3. Brule River, 1991
4. Middle River 1991
5. Bark Bay Slough, 1991
6. Stoney Point, 1991
7. Kaministiquia River, Canada, 1991
8. Thunder Bay, Canada, 1991
9. Iron River, 1992
10. Flag River, 1992
11. Sand River, 1992
12. Bad River, 1993
13. Red Cliff Creek, 1993
14. Sioux River, 1993
15. Lost Creek Slough, 1993
16. Siskiwit River, 1993
17. Raspberry River, 1993
18. Ontonagon River, 1994
19. Chequamegon Bay, 1994
20. Black River, 1994
21. Oronto Creek, 1994
22. Saxon Harbor, 1994
24. Two Harbors, 1995
25. Kakagon River, 1995
26. Presque Isle River, 1996
27. Neebing River, Canada, 1996
28. Bear Island, 1997
29. Taconite Harbor, 1997
31. White River, 1998
32. Firesteel River, 1999
33. Current River, Canada, 2001
35. Sturgeon River Sloughs, 2002
36. Bark Point, 2002
37. Raspberry Island, 2002
38. Stockton Island, 2002
40. Marquette Harbor, 2004
41. Misery River, 2004

Lake Huron

23. Thunder Bay, 1995
30. Thunder Bay River, 1997

Lake Michigan

34. Little Bay de Noc, 2002
39. Big Bay de Noc, 2004

Gary Cholwek

Data Source: U.S. Fish and Wildlife Service and the U.S. Geological Survey. Map produced by the U.S Geological Survey. March 22, 2005.